SUMMARY OF THE PROTON ACCELERATOR GROUP

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After a general discussion the group agreed to consider a definite energy of 20 TeV. The problems specific to the design of a proton synchrotron of that energy were expected to clarify the limiting energy. It is anticipated that in ten or fifteen years superconducting magnets will attain fields of 10 T and will be available for the construction of the accelerator. This technology will considerably reduce the cost of construction and operation. The design intensity was chosen arbitrarily to be 10^{13} protons/second with a cycle which would include 20 seconds of filling, 40 seconds of acceleration and 40 seconds of magnet recovery.

The discussion led to a magnet ring of average radius about 12 km The cells with dipoles would occupy 65 km, the cells without dipoles (total straight section) would occupy 9 km. With the 100 second cycle the protons per pulse would be 10^{15} which corresponds to a frightening energy of 3000 MJ stored in the beam at 20 TeV.

An 8 cm diameter beam pipe implies that the total stored energy in the magnetic field would be about 8000 MJ. It is anticipated that the average static load due to radiative and conductive heat loss in the superconducting magnets would be about 75 kW. The load loss in the leads would be about 10 kW and the loss due to ramping the magnetic field would be about 200 kW.

The total average power requirement of the accelerator might be about 300 MW of which the rf system would take about 100 MW.

Exclusive of the injector system (which might correspond to the equivalent of a Tevatron) and of the experimental areas, the cost might be one or two billion dollars depending on the conditions of construction.

No serious problem of beam dynamics were encountered for the 20 GeV example. Very serious problems were anticipated associated with beam losses. Although the use of normal iron-copper dipole magnets placed downstream of regions were beam losses will occur will be helpful, this problem was not resolved and must be further investigated for it will be the most important limitation of the intensity.

The conclusion of the group is that there does not appear to be a fundamental obstacle in the construction of a 20 - TeV proton accelerator, although there might be trouble in reaching an average intensity of 10^{13} protons per second. It would be useful to examine a 30 TeV or even higher energy machine in order to better determine if a limiting energy exists, or if the physics interest should require such an energy.